Proposal of the Name *Chaetomorpha vieillardii* (Kütz.), n. comb., for a Large-Celled Tropical *Chaetomorpha* (Chlorophyta)[1]

Michael J. Wynne[2]

Abstract: Type material of *Bangia vieillardii* Kütz. from New Caledonia has been studied and determined to belong to the green algal genus *Chaetomorpha*. The name *Chaetomorpha vieillardii* (Kütz.), n. comb., is effected, and this binomial is proposed to serve for what has previously been known in tropical seas as *C. crassa*. Genuine *C. crassa* (C. Agardh) Kütz., based on European type specimens, has been treated by others to be conspecific with *C. linum* (O. F. Müll.) Kütz.

The name *Chaetomorpha crassa* (C. Agardh) Kütz. has been commonly applied to a large-celled, usually unattached filamentous green algal species of the genus occurring commonly in tropical and warm temperate waters. The species was originally described by C. Agardh (1824, as *Conferva crassa*) from syntype localities in Italy and England. It has been distinguished from the widespread *C. linum* (O. F. Müll.) Kütz. by the crisp (stiff and wiry) filaments and thicker walls in contrast to the rather lax filaments and thinner walls in *C. linum* (Sartoni 1992, Littler and Littler 1997, Coppejans et al. 2009). Both species are reported to form clumps, often entangled with other algal species. Although cell dimensions are usually reported to be greater in *C. crassa* than in *C. linum* (Littler and Littler 2000), there is some overlap; filament diameters in *C. linum* reach 1,000 μm (Leliaert and Boedeker 2007). A recent treatment of *Chaetomorpha* in Britain and Ireland (Leliaert and Boedeker 2007) came to the conclusion, based on unpublished data by Boedeker, that *C. crassa* is conspecific with *C. linum*, but the tropical "*C. crassa*" is morphologically and genetically distinct (see also Hanyuda et al. 2002, Leliaert et al. 2003). This taxonomic synonymy had been earlier suggested (Parke and Dixon 1976) on the basis of an unpublished Ph.D. thesis (Price 1967). According to Leliaert and Boedeker (2007) the so-called tropical "*C. crassa*" has to be renamed because the type of *C. crassa* is based on European material. In this note I propose to offer an appropriate name to be applied to this widely occurring unattached tropical *Chaetomorpha*.

A paper by Millar and Prud'homme van Reine (2005) did much to clarify the uncertain status of a number of species of benthic marine algae that had been collected by Eugéne Vieillard in the period 1855–1867 from New Caledonia and described by Kützing. Kützing described and validated some of the names of these Vieillard collections in an obscure publication, which was printed as the Easter program of the secondary school where he taught (Kützing 1863*a*). But this publication was reprinted in the same year in the journal *Hedwigia* (Kützing 1863*b*), facilitating its dissemination. This communication will also clarify the status of *Bangia vieillardii* Kütz.

Materials and Methods

Two isotypes of *Bangia vieillardii* in the University of Michigan Herbarium (MICH) were studied in this report. A microimaging system (Epson Scan Ver. 1.28A, Seiko Epson Corp.) was used to capture an image of one of the isotypes of *Bangia vieillardii*, and the software program Adobe Photoshop CS3 Version 10.0

[1] Manuscript accepted 20 April 2010.

[2] University of Michigan Herbarium, 3600 Varsity Drive, Ann Arbor, Michigan 48108 (e-mail: mwynne@umich.edu).

Pacific Science (2011), vol. 65, no. 1:109–115
doi: 10.2984/65.1.109

was used to prepare Figure 1. The line drawings were prepared using a camera lucida mounted on a standard research microscope (Zeiss). Author abbreviations of taxa are in accordance with Brummitt and Powell (1992), and herbarium abbreviations are according to Thiers (2010). Colleagues at Université de Caen (CN), Caen, France, and Muséum national d'histoire naturelle (PC), Paris, France, were requested to check for any material of *Bangia* (or *Chaetomorpha*) *vieillardii* in their holdings.

RESULTS

Millar and Prud'homme van Reine (2005) were able to examine many of the Vieillard collections of algae from New Caledonia, which are now deposited in the Nationaal Herbarium Nederland (L). But regarding *Bangia vieillardii*, Millar and Prud'homme van Reine indicated that their material (the holotype) was "not well preserved" and "thus difficult to identify with certainty." Kützing's (1863*a*,*b*) description of *B. vieillardii* is the following: "B. trichomatibus crassis setaceis, rigidis, cartilagineis, maxime curvatis et crispis, inaequaliter nodulosis, omnibus opacis; cellulis numerosissimis minoribus, monogonimicis.—Neu-Caledoniae." De Toni (1897) treated this taxon unchanged in status but in the category of "Species mihi omnino ignotae aut valde dubiae."

I noticed that in MICH there are two packets of what clearly represent isotypes of *Bangia vieillardii*, both Vieillard No. 2010 (Figure 1),

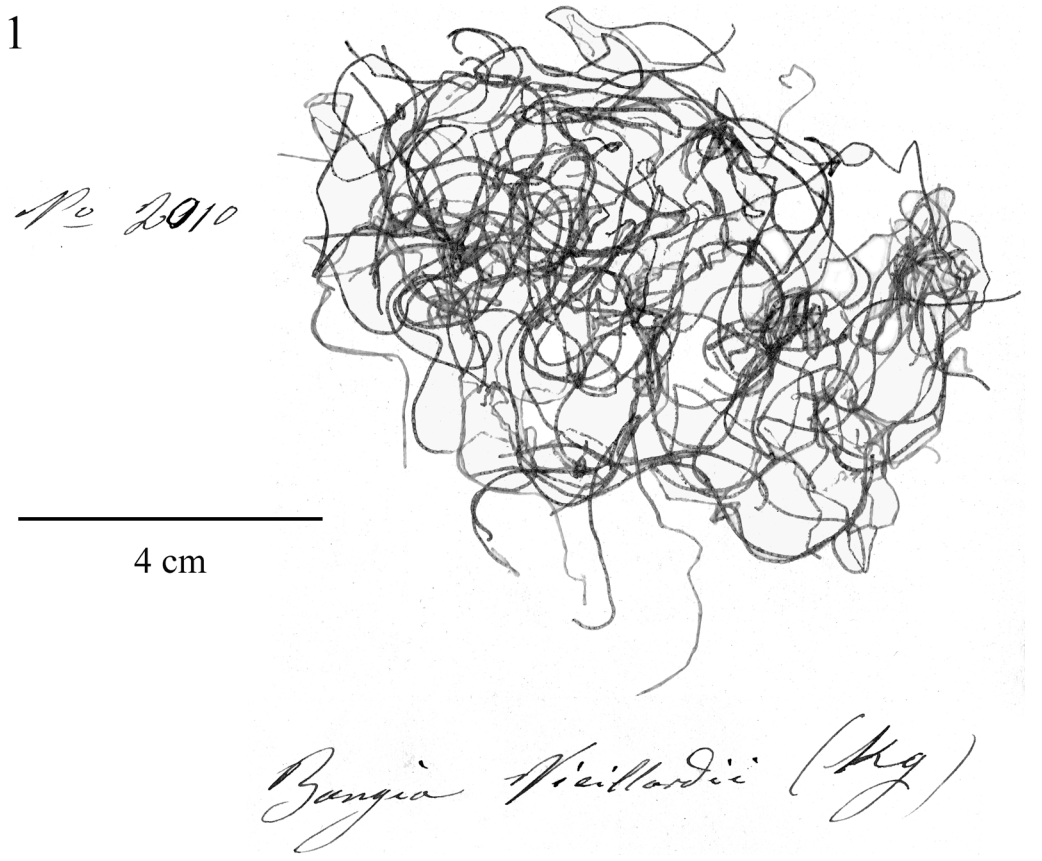

FIGURE 1. Isotype of *Bangia vieillardii* Kützing in MICH.

Loc. Wagap, Novelle Calédonie, both distributed by the "herb. Lenormand," and both bearing the names "*Bangia Vieillardii*" and "*Chaetomorpha Vieillardii* (Kg.) Lenorm." This latter name appears never to have been validated. The material in both isotypes is abundant and well preserved. This alga is clearly a *Chaetomorpha* as Lenormand had thought. The simple filaments are slightly curving and loosely entangled. Cells measure 486–534(–568) μm in diameter and (486–)730–890(–1,020) μm in length, with a mean length/width ratio (LWR) of 1.0–1.5(–1.8) (Figure 2). Cell walls appear thick, measuring 10–14 μm. The filaments are slightly constricted at the septations. No obvious or distinctive basal attachment cells were observed. Such words in the protologue as "crassis," "rigidis," "cartilagineis," and "crispis" do conform to the concept of this widespread "*C. crassa*" in need of a proper name.

Eight isotypes of *Bangia* [*Chaetomorpha*] *vieillardii* (collected by Vieillard) are present in the Vieillard Herbarium in CN, all in Vieillard's handwriting with annotations by Lenormand: "E. Vieillard herb. De la Nelle Calédonie no. 2010" and "*Chaetomorpha vieillardii* Kg (nobis)." No material of *B. vieillardii* was found in PC.

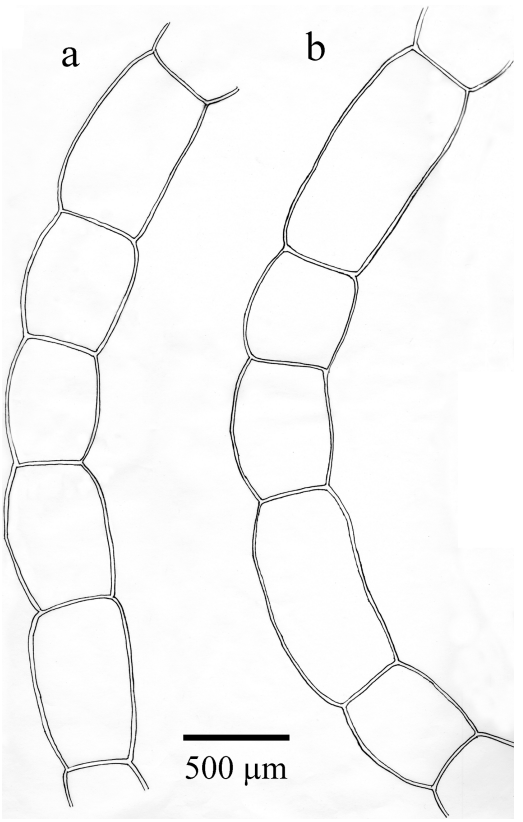

FIGURE 2. Camera lucida drawings of portions of filaments (*a*, *b*) of *Bangia vieillardii* (= *Chaetomorpha vieillardii*) from isotype in MICH.

DISCUSSION

So-called *Chaetomorpha crassa* has been widely recorded from tropical seas including reports from Papua New Guinea (Coppejans et al. 1995, 2001*b*), Indonesia (Coppejans and Prud'homme van Reine 1992), Guam (Lobban and Tsuda 2003), Fiji (N'Yeurt at al. 1996, South and Skelton 2003), throughout the Indian Ocean (Silva et al. 1996), including the east coast of Africa (Jaasund 1976, Sartoni 1992, Coppejans et al. 2001*a*, Leliaert et al. 2003) and Sri Lanka (Børgesen 1936, Coppejans et al. 2009), the Philippines (Trono and Ganzon-Fortes 1980, Calumpong and Meñez 1997), Pacific Mexico (Pedroche et al. 2005), Chile, Peru, Isla Juan Fernández and Easter Island (Ramírez and Santelices 1991), tropical West Africa (John et al. 2003), and the tropical/subtropical western Atlantic (Taylor 1960, Schnetter 1978, Ballantine and Wynne 1986, Schneider and Searles 1991, Littler and Littler 2000, Schneider 2003, Dawes and Mathieson 2008, Alves et al. 2009). But it has also been recorded from warm temperate waters of Japan (Yoshida 1998) and Korea (Lee and Kang 1986). It is worth mentioning that this unattached tropical *C. crassa* has an economic role locally in the Indian Ocean, such as in Tanzania (Oliveira et al. 2005) and in the Philippines and other Southeast Asian sites, where it is used in the human diet (Zaneveld 1959, Trono and Ganzon-Fortes 1980).

Measurements of the cell diameter in the type material of *Bangia vieillardii* compare favorably with those reported for so-called

Chaetomorpha crassa: 600–700(–900) μm (Trono and Ganzon-Fortes 1980); 450–750 μm (Sartoni 1992); and 400–650 μm Coppejans et al. 2001*b*). According to Coppejans et al. (2009), this widely occurring species can be easily distinguished from other unattached *Chaetomorpha* species by the coarser filaments. The cell size, however, does not come close to the much larger size of the cells in the attached species *C. coliformis* (Mont.) Kütz., occurring in southern Australia (Womersley 1984), New Zealand (Adams 1994), and Chile (Hooker 1847, as *Conferva clavata* var. *darwinii* Hook. f. & Harv.). *Chaetomorpha coliformis* has filaments with mature parts 1–4(–5) mm in diameter (Womersley 1984). Similarly, the cell sizes of *C. melagonium* (F. Weber & D. Mohr) Kütz., a widely occurring attached species, are greater in width (about 1 mm) and with a basal attachment cell 2–3 mm long (de Goër and Noailles 2008, Leliaert et al. 2009). *Chaetomorpha melagonium* is a cold-temperate Northern Hemisphere species (records from South America, Australia, and New Zealand need to be confirmed by molecular data). The widespread tropical attached species *C. antennina* (Bory) Kütz. is distinguished by the basal cells having annular constrictions and the characteristic brush-like tufts (De Clerck et al. 2005, Coppejans et al. 2009). *Chaetomorpha firma* Levring is an attached, large-celled species but is distinguished by the very long basal cells (1–3 cm in length), without annular constrictions; it is endemic to Chile and its oceanic islands (Levring 1941, Hoffmann and Santelices 1997). Thalli of *C. robusta* (Aresch.) Papenf. are large-celled, attached filaments, the distal cells becoming almost spherical and up to about 2 mm in diameter (Simons 1976) and basal cells 5–12 mm long. This species is restricted to South Africa (Stegenga et al. 1997) and Namibia (Rull Lluch 2002). *Chaetomorpha moniligera* Kjellm., with a distribution restricted to Japan and Korea, is also a species with attached, large-celled filaments. Its filaments are fine, soft, and slender and attached by a discoid holdfast (Okamura 1929). Finally, the attached, large-celled filaments of *C. spiralis* Okamura, with a wide range in temperate and tropical waters of the Pacific and Indian oceans, are distinctively coiled (Okamura 1912, Abbott and Hollenberg 1976, Coppejans et al. 2009).

According to Silva et al. (1996), *Chaetomorpha torulosa* Kütz. (Kützing 1845) is conspecific with *C. crassa*. *Chaetomorpha torulosa* is regarded as a nomen novum, being based on the illegitimate name *Conferva torulosa* Kütz. (Kützing 1845), with a type locality of Croatia, Adriatic Sea. Silva et al. (1996) based that treatment on the authority of Ardissone (1886). The current treatment by Leliaert and Boedeker (2007) of *C. crassa* as conspecific with *C. linum* also means that the European-based *C. torulosa* is a taxonomic synonym of *C. linum*.

In conclusion and in light of the information presented here, the following transfer is effected:

Chaetomorpha vieillardii (Kütz.) M. J. Wynne, n. comb.

BASIONYM: *Bangia vieillardii* Kütz., 1863a:10.

HOLOTYPE: L 939,271–939,279 (fide Millar and Prud'homme van Reine 2005).

ISOTYPES: In CN and MICH.

The name *Chaetomorpha vieillardii* is proposed as being available to apply for tropical collections of *Chaetomorpha* with appropriate large cell sizes that had formerly been identified as *C. crassa*, now that that name has been treated as a taxonomic synonym of *C. linum*.

ACKNOWLEDGMENTS

I am grateful to Dr. Chantal Billard of Université de Caen, France, and Dr. Bruno de Reviers of Muséum national d'histoire naturelle, Paris, France, for their assistance in searching for additional material of *Bangia vieillardii*. I also thank Jeff Nero of PC Helps Support, LLC, Philadelphia, for his remote assistance in preparing the figures.

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